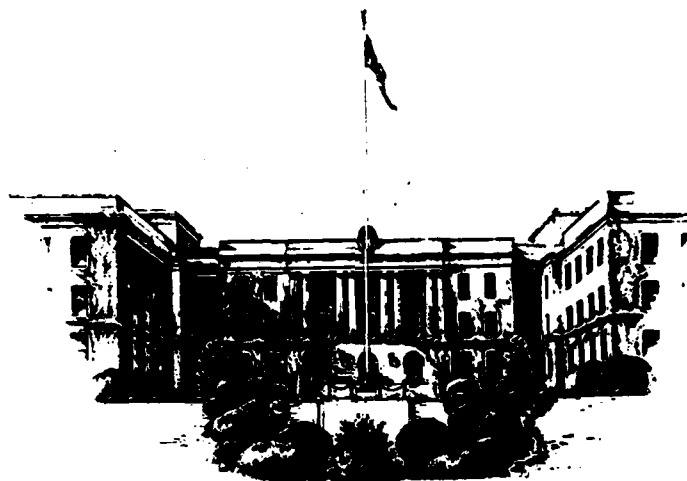


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# Deployment Threats to Rapid Deployment Forces



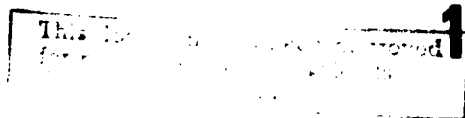
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**DIVISION OF NEUROPSYCHIATRY**

**Walter Reed Army Institute of Research**

**Washington, D. C. 20012**

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DEPLOYMENT THREATS TO RAPID DEPLOYMENT FORCES

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## PREFACE

This paper is one of a series of occasional, informal accounts of work in the Division of Neuropsychiatry at the Walter Reed Army Institute of Research. The reports generally address topics in Army preventive medicine for which implementation responsibility lies significantly outside the Medical Department. Although their contents may overlap partly with our publications in the scientific literature, most papers are based on trip reports, briefings, and consultations involving specific Army audiences. Comments to the senior author are welcome.

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*June* → **CONTENTS** *including*

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## INTRODUCTION

The historical roots of this document are to be found in an aborted Combat Development Command study known as OPERATION FAASTO that was conducted in the early seventies. This acronym stood for Fatigue Acclimitization Asynchronosis and Sustained Tactical Operations, indicating an early appreciation of the fact that Rapid Deployment operations are subject to human stressors from multiple sources. OPERATION FAASTO drew on scientific knowledge from a number of disciplines in an attempt to develop an integrated body of operational guidance. The motivation was correct, but the timing was premature. The fact that the interaction of human stressors does not respect disciplinary boundaries as was not sufficiently well appreciated at that time.

No single stressor, operating alone and at moderate intensities, appears to be sufficient to cause operationally significant performance decrements. Even unexceptional leadership and barely acceptable levels of morale will generally be sufficient to maintain performance through the expenditure of additional individual and team effort required to compensate for the action of the single stressor. The exceptions to this rule of thumb are provided by instances of poor leadership and low morale which potentiate the performance impact of even low and moderate stressor levels. However, individual stressors rarely operate alone in operational environments. Instead, they most often act together and their combined impact can impair operational capacity sufficiently to become a matter of concern.

The deleterious impact of combined stressors is especially important in military situations which require full performance capability to be maintained for extended periods of time. The capacity of leadership and good morale to stimulate efforts to compensate for the action of stressors decreases as their number and intensity increase. There is an important interaction between the number and intensity of stressors and the length of time soldiers are exposed to their action. The greater the number and intensity of the stressors present, the sooner their impact will be felt. Compensatory efforts themselves exact a cost that will become part of the complex of stressors that impact on those in leadership positions.

The same principles apply to any remedial actions undertaken to ameliorate stressor impact. No single action is likely to be sufficient to maintain performance capacity. Instead, a wise and coordinated application of a mixture of practical stressor countermeasures will significantly reduce the impact of multiple stressors on military performance. Stressor countermeasures are not effective when applied in a shotgun approach. They should be selected and tailored to particular situations on the basis of what stressors are present, at what intensities, and for what periods of time. A set of remedial actions are chosen on the basis of what is practical and doable within the operational and resource constraints imposed by situational and mission constraints.

There is a lamentable tendency to seek a "universal fix" or "magic bullet" for problems relating to military stress and performance. We Americans often act as though we believe that there is a quick technical solution to any problem. Matters aren't helped by the presence of a clique of civilian hucksters peddling Twentieth Century patent medicines guaranteed to cure all the ills of the body military. It doesn't work that way. Today's soldier is not biologically different in any significant way from Caesar's legionnaires. The challenges have changed but basic human needs and requirements remain unchanged.

The best military commanders have always understood the importance of caring for their troops. They have always understood that the consequences of caring are expressed in terms of a positive multiplier applied to the equation of success on the battlefield. Victory has not always gone to the big battalions. An extra measure of vigilance, stamina, and loyalty have often been sufficient to swing the balance of the battlefield equation. While this has always been true, the demands of the contemporary and prospective battlefields can only work to increase the importance of the human element in combat.

We have attempted to adhere strictly to these principles in preparing the material that follows. Rapid deployment operations are viewed as a sequence of activities that occur in a logical order. Some activities are associated with a particular set of biological, psychological and social stressors. Others involve stressors that are viewed as being generally applicable to the entire operation. Each deployment activity is covered in the order of normal occurrence. Specific stressors are dealt with as they would

occur in the deployment sequence. Attention is frequently drawn to handling the more general stressors in each activity. This creates some redundancy in coverage that may be bothersome during the first reading. The redundancy is intended as a means of reinforcing important points and facilitating reference review of particular sections at a later time.

Specific practical actions are suggested that take into account natural variations that occur among deployments as a consequence of differences in such factors as type of unit, nature of the deployment, and mission. The objective is to provide commanders and their staffs with the information they need to develop and effect tailored prescriptive plans that are matched to their situations and missions. The goal is to maintain the combat effectiveness of deploying forces.

#### JET LAG AND BIOLOGICAL RHYTHMS

Jet Lag is the name for a common affliction suffered by many travellers who use modern air transportation to travel long distances in relatively short periods of time. The more technically minded often refer to this traveller's affliction as transmeridian desynchronization or desynchronosis. All of these terms are different ways of saying the same thing. No matter what we call this disorder, there is a clear implication that a change in time is responsible for the bad effects that are suffered by modern travellers. We will begin our discussion from that perspective. However, we cannot emphasize too strongly that time zone shifts associated with modern travel are not sufficient to explain all of the effects associated with Jet Lag.

From the reference point of your present location in the world, points to the East or West of your position have sunrise and sunset occurring either earlier or later than at your position. This fact is responsible for the creation of twenty-four time zones, each one hour apart, that girdle the globe and establish the time to which clocks within each time zone are synchronized. If people living at each location around the world set their clocks in accordance with local sunrise or sunset, the result would

be chaos. If you lived in New York and wanted to call your Aunt Tilly in San Francisco at 0900 her time, it would be difficult to do so without an orderly system of time zones.

The way in which we set our clocks has a lot to do with the way in which we organize our lives. We get up and go to bed in accordance with the clock. We eat by the clock, we work by the clock, and we party by the clock. This is so obvious as to appear simple-minded. It is perhaps less obvious that the internal biological functions of our bodies are also organized by the local clock. The clearest example of this is to be found in the orderly sequence of waking and sleeping. The alteration of periods of sleep with periods of awake activity represent an easily observed biological rhythm. There are many other examples of similarly organized biological rhythms that are not so easily observed.

If we place a person in an environment without clocks, or any other means of marking the passage of time, we find that his or her biological rhythms continue. However, there are changes in the timing pattern of the rhythm. Using our example of sleeping and waking, after a week or so without time we might observe one twelve hour sleep period every thirty-six hours instead of an eight hour sleep every twenty-four hours. The internal clock is still running, but the time between ticks has changed and the clock has apparently slowed down. While this change in the timing of the biological rhythm would be obvious to observers placed outside the time-free environment, it is highly unlikely that our human guinea pig living inside would notice the difference. Many experiments of this sort have been conducted in laboratories around the world in an effort to understand this phenomenon and its implications for human health and functioning.

Eventually we would have to bring our subject back out into the world of clocks, regular mealtimes, periods for work and play, and day and night. At this point, we would very quickly find our subject experiencing some difficulty. His internal clock would be out of step with ours. Our subject would want to sleep while we are awake and about our business, or eat at inappropriate times and so on. Our subject's internal clocks will readjust to the world after a period of time, but while that is happening, he will experience some trouble.



Imagine for a moment that you are the subject of this experiment. Part of the trouble will arise from the fact of desynchronization itself. If those around you expect you to work when you want nothing more than to sleep, you have a problem. Your capacity to perform is very likely to be less than optimal and you are likely to make mistakes in judgment and commit errors of omission and commission. A second source of trouble is traceable to what is happening within your body.

We mentioned earlier that most of your biological functions are rhythmic in character and wax and wane as regularly as clockwork. It is important to understand that, under normal conditions, all of these rhythms operate in fairly specific relationships to one another. The smooth functioning of the body, as a system, depends on the maintenance of these timing relationships. The consequences of disturbing biological rhythm relationships can be far-reaching, ranging from "feeling lousy", feeling fatigued and irritable, to serious sleep disorder, headache and acute intestinal upset. The particular symptoms experienced and their severity vary from individual to individual. Add these internal troubles to the external troubles mentioned earlier and we have created a recipe for ineffective performance..

The disturbance in the neat coordination of internal biological rhythms occurs in our human guinea pig because all of his internal rhythms do not adjust to the new conditions at the same rate. Some may adjust in a day or two, others may take two weeks. The same process occurs in people who move rapidly from a time zone in which they are well-adapted to a time zone that is hours different. The greater the time zone shift in hours, the greater the desynchronization between external and internal time and the more trouble individuals are likely to experience. Some individuals appear to be more severely affected by time zone shift than others. There is even some evidence to suggest that moving the clocks ahead in the Spring and back in the Fall by one hour results in mild desynchronization in susceptible people.

The trouble described above is Jet Lag in its purest form. The bottom line is that pure jet lag has nothing to do with jets and travel. Instead, it has a great deal to do with the relationships among various internal biological rhythms and between those internal rhythms and what is happening in the environment. Viewed from this perspec-

tive, jet lag and its attendant problems are closely allied to other types of clock-related difficulties associated with shiftwork, sleep deprivation, and the kind of fragmented living pattern that is likely to result from participation in a sustained operations scenario. For now, it is sufficient to realize that the problems of jet lag for the soldier do not necessarily start when he gets off the plane.

We doubt that a pure case of jet lag, i.e., involving only the consequences of time zone shift, ever occurs in practice. The preparations necessary for modern travel and the travel itself involve a variety of difficulties which, individually and collectively, cause the traveller problems. At its core, travel is a complex process involving change and transition. Some of these changes are small and apparently insignificant, others loom large in their effect on the personal life of the traveller. Some transitions are very abrupt and others extend over days. It is the overall pattern of these transitions, in combination with the susceptibilities of the individual traveller, which produce the deleterious effects associated with modern high-speed travel.

Only a few individuals can begin a long trip by simply pulling up stakes, catching the plane and going. Such people are generally highly experienced travellers who hold jobs that require that kind of travel. For the rest of us, there are one hundred and one personal and work details that have to be taken care of before we can even leave for the airport. The list ranges from doing the necessary paperwork, through packing underwear, to cancelling the delivery of the morning paper. Arrangements and adjustments have to be made with family and friends. Taken together, all of the factors that go into preparing for travel can be a significant source of psychosocial stressors. The degree to which the frequent and seasoned traveller has adapted to, learned to cope with, and planned for the stressors associated with modern travel are important factors separating that individual from the majority of travellers.

International air travel timetables can be another source of stress for the traveller. It is not at all unusual for a departure to be scheduled at the height of rush-hour which not only makes arrival at the airport safely and on time questionable, but may also disrupt a major meal. There is inevitably a good deal of hurry up

and wait associated with departures that is, in and of itself, a source of stress. The actual process of departing is not innocuous. It must be viewed as a personal transition that may have a significant potential for stress production.

Although air transport has evolved a long way from the Ford Trimotor and the DC-3 in terms of passenger comfort, it is still a long way from the living room in the sky touted by airline commercials. Crowded seating and forced immobility, high altitude and low humidity, abnormal eating patterns, heat and/or cold, and noise and vibration are all present to a greater or lesser degree. These represent a set of physiological stressors that alter an individual's internal economy and can adversely affect well-being and performance capability.

It is tempting to assume that the problems associated with modern long-range travel are ended when the wheels of the aircraft touch down on the destination runway. Unfortunately, this is not the case. Our traveller arrives in less than optimal condition as a consequence of the interactive effect of the stressors outlined above. Awaiting him are not only the consequences of whatever time zone shift has occurred, but also the requirement to accomplish whatever ends motivated the travel in the first place. These ends may range from starting a vacation to immediately entering high stakes business or governmental negotiations.

Strange environments, new languages and unfamiliar customs can create a new set of psychosocial stressors. The destination point may differ significantly from home in terms of climate and/or altitude which provides a new set of physiological stressors. Finally, our traveller's destination most probably represents a new environment with respect to the bacteria and viruses that are prevalent in, on and around the inhabitants. Though a picture of health at home, the new arrival in a foreign environment is most likely to find himself a sitting duck for the first alien bug he encounters.

Thus far we have described the situation that in broad terms faces any traveller who must utilize high speed air transportation to cover long distances. The situation facing the modern military traveller is basically not different in kind from that faced by civilian contemporaries. If we consider the normal military PCS to an

overseas post, it is likely to be a very similar experience. However, when we consider military operations that involve the rapid deployment of bodies of troops to distant points for maneuvers or combat, a number of the stressors outlined above increases dramatically in their severity and thereby holds greater potential for adversely affecting the combat readiness of the force.

We have described a complex and interacting set of stressors which, acting in concert, can impair combat readiness. Research done by U.S. Army scientists in recent years indicates that, on the average, there is a 15% decrement in the performance of a group of mental tasks that are common to a wide variety of military occupational specialties (MOS). For some individuals, the decrements experienced were greater. For others they were less severe. Older soldiers tended to be more severely affected than younger soldiers. Those same studies demonstrated that a relatively simple set of interventions, or countermeasures, could be employed by units to reduce the performance decrements by nearly two-thirds.

No two deployment scenarios are alike in terms of the realities of their execution. No intervention that is carried out to produce a benefit is without associated costs. Some countermeasures against the stressors of deployment are workable in some situations, and not in others. Therefore, we will not attempt to write a single prescription to cover all deployment situations that units can be expected to face. Instead, we will identify critical features of the deployment process and associate with these features actions which can be expected to reduce their adverse impact. Commanders and their staffs must then examine their own situations and implement those deployment stress countermeasures that fit the realities of mission and resources.

#### CONCEPTUAL AND TECHNICAL FRAMEWORK

The medical problems associated with providing effective support for rapid deployment operations should be approached from a consistent conceptual and technical point of view. As discussed above, the phenomenon of "Jet Lag" is seen as the consequence of an interacting set of psycho-

social, physiological and environmental factors. The establishment of effective countermeasures requires that appropriate interventions from all three factor areas be selected and implemented within the framework of a coherent set of contingency plans. The criticality of prior planning will be stressed throughout this document. From the outset, it should be recognized that one viable planning option is to decide to do nothing about the problems associated with "jet lag". Troops have undertaken long distance rapid deployments in the past without using countermeasures and it is clear that they can do so in the future.

However, we hope that commanders will find the reasons for expending the effort to plan for and establish an effective countermeasures program to be persuasive. The critical and inescapable goal of medical support for military operations is Force Conservation. Subsidiary objectives of this goal are casualty avoidance, reduction, and treatment. Within the framework of rapid troop deployment, these objectives are further refined as the delivery of fighting forces to their destinations unimpaired in their psychological and physiological capacity to meet and master the multiple challenges of combat.

Army data indicate that the deleterious effects of the Jet Lag syndrome are most marked in cognitive and intellectual functions. It also appears that older soldiers are at greater risk of being affected by the syndrome than are younger soldiers. Taken together, these findings point to command and control functions as being at greatest risk at a time when they should be optimally effective. The 15% performance decrement figure quoted earlier is known to be statistically significant. But, we cannot evaluate the operational significance of a decrement of that size quite so easily.

The operational significance of a performance decrement depends heavily upon the situation in which it occurs and upon the role of the affected individual. The actions of individuals who exercise command and staff functions have a force multiplier effect since they govern the actions of others. The prevalence and importance of crew-served weapon systems extends critical performance situations throughout the force. This point requires further comment. We must distinguish between aggregate and critical performances when examining the function of crews.

In an aggregate performance, all members of the crew are basically doing the same thing, e.g., unloading a truck. If each member of the crew suffers a 10% performance decrement, the aggregate effect is the same as losing 10% of the crew. A critical performance depends upon a structured sequence of actions on the part of individual crew members, e.g., aiming and firing a tank's main gun. In a critical performance, individual performance decrements interact and compound their impacts on the sequences of actions which, taken together, constitute the crew performance. The same 10% individual performance decrement could result in a 100% crew performance decrement in critical situations. Therefore, relatively small errors can have profound consequences in critical performance situations.

The rationale for adopting an effective Jet Lag countermeasures program flows from this set of observations about the operational consequences of error. When faced with a tough opponent, it simply does not pay to give anything away in the opening play. The medical support task in rapid deployment operations closely resembles that of helping to bring world class athletes to the starting line, anywhere in the world, on short notice, ready to run the most important race of their careers. However, this analogy is incomplete. Since the most likely follow-on to a rapid deployment operation is a sustained operation, the question of performance sustainability must also be considered. Starting a sustained operation with Jet Lag is much like starting a forced march with a half empty canteen.

#### PRE-NOTIFICATION PERIOD

The pre-notification period is that indeterminate period of time that occurs between deployments of a unit. It ends with receipt of notification for a deployment.

Jet Lag countermeasures will only be effective if they are an integral part of a unit's deployment SOP. This means that all necessary actions must be pre-planned and coordinated with all of the key players. The practice of countermeasures should become a normal part of training in much the same way that water discipline is practiced in field exercises. Notification to deploy is clearly not the

appropriate time to start to think about Jet Lag. There are more important actions to be taken at that point.

While we can break the deployment process down into stages and describe the types and ranges of risk factors that are likely to occur at each stage, no two deployments are likely to be the same. The structure, missions and readiness to move varies among units. Direction of movement, time of departure, distance of the move, and many other factors will play a role in the selection and implementation of appropriate countermeasures. Therefore, one single prescription will not fit all.

**Planning Countermeasures:** The remainder of this document will provide the information needed to develop a countermeasures plan that is tailored to the needs of individual units. Whenever possible, the guidance provided will be as pointed-out and specific as our current state of knowledge allows. In other cases, the guidance provided will do little more than point out reasonable courses of action.

Different units are expected to evolve different plans that are tailored to their specific requirements. Operational experience should provide the basis for discriminating between what works well in what situations. A given unit will likely prepare a number of contingency scenarios. You will find that a number of countermeasures are common to any deployment and can be implemented generally. Others must be invoked as required. We strongly emphasize that experience with various countermeasures should lead units to evolve more effective procedures. Once the basic principles are understood, there is ample room for creative innovation.

#### PREPARATIONS FOR DEPLOYMENT

The receipt of notification to deploy is a powerful energizing stimulus for all units. It marks the beginning of a far-reaching transition from garrison to operational status. The impact of this transition will largely be determined by the interaction of three factors. These are:

1. The readiness status of the unit with respect to mounting a deployment operation. Put simply, how much work has to be done before the troops can emplane?

2. The amount of time that is available to get the job done and to accomplish the transition.

3. The reason for the deployment being undertaken.

A "Best Case", in these terms, would be described by a unit whose normal mission includes frequent deployments preparing for a long-scheduled, low profile, routine training exercise in a location just two or three time zones away. The "Worst Case" would include such factors as the balloon having gone up in a far distant and very unfriendly part of the world, the unit in question not having deployed in the last five years, and the troops expected to be on the ramp, ready to go, in thirty days, or less. The majority of deployments can be expected to fall between these extremes.

Where a unit falls on this continuum will determine the degree to which it must adopt a sustained mode of operation in preparation for the move. We define a sustained operation as a situation in which work must be done outside normal duty hours under heavy time and deadline pressure. The stepped-up pace of necessary military work is accompanied by a heightened set of demands in the private life of the soldier. The young soldier in today's Army is married to an equally young and inexperienced spouse. Their economic status is likely to be marginal and the separation associated with deployment is likely to create a set of personal threats. The older soldier and his or her dependents are very likely to be more experienced with separation and to possess more adaptive coping mechanisms. Even so, a great deal of practical and emotional business must be transacted prior to deployment.

This situation provides fertile ground for the development of fatigue and sleep debt arising from heavy work demands. Conflict and anxiety associated with impending separation add to the individual's stress load. Workload and familial demands interact negatively upon one another to the extent that both compete for time and attention. Given this heightened stress profile, the frequency of disruptive behaviors associated with drug and alcohol use, aggression, duty avoidance, and inappropriate use of



medical facilities can be expected to increase markedly. This increase in morale and discipline problems occurs when the unit is least capable of dealing effectively with them due to the pressure of competing demands.

The specific guidance presented below must be based on the outcome of activities undertaken and completed during the pre-notification Period. These activities include:

1. The analysis of the unit's deployment scenarios.
2. The analysis of the unit's direct, mission support, and personnel resources.
3. The analysis of the unit's indirect mission support.
4. The analysis of the unit's dependent support mechanisms and institutions.
5. The development of a coherent operational plan.
6. The coordination and implementation of those elements of the plan that must be in place prior to notification.

In general, the demand characteristics of work determine the rate at which individual resources are expended. Rest restores resources and makes them available for expenditure in future performance. If the resource depletion created by performance demands is matched by the resource restoration provided by rest, then the equation balances and a particular work/rest schedule can be expected to maintain effective performance indefinitely. If, on the other hand, resource depletion exceeds resource restoration, a net deficit will accrue. The effects of this resource deficit will result in slowing of the pace at which work can be maintained, increases in errors of omission and commission, increases in irritability, and deterioration of morale.

Typically, resource deficits are redressed by the interpolation of rest periods that extend over days (R & R for example), or weeks (pulling entire combat units out of the line in WW II and Korea). Three separate time periods

must be considered if sustained work is to be organized in a way which maintains effective performance over some target period of time. These are:

1. The duty day
2. The duty week
3. The duty month

The method of organizing duty periods depends upon the most important characteristics of the situation that creates the performance demand. Availability of personnel resources to meet the and the amount of time available are clearly critical factors.

If the situational demands are great and the time allotted to meet the demands is limited, attention must be centered on the duty day. It is the longest period of unbroken required activity that controls the need for subsequent periods of rest. If restoration cannot be accomplished within the framework of the duty day, then the duty week must be carefully organized, and so on.

The period of preparation for deployment is firmly bounded by the requirement to load troops and equipment on an aircraft in accordance with an established schedule. Given the work to be done, the time available to do it, and the number of personnel available, it is unlikely that a work/rest schedule can be established that avoids the accumulation of sleep debt and fatigue. In such cases, the task becomes one of damage control with the goal of minimizing adverse consequences to soldiers and mission.

Earlier, we mentioned the need of soldiers preparing for deployment also to address the needs of their dependents. A carefully worked out work/rest schedule is potentially more damaging than no plan at all if it assumes that soldiers are resting when they are doing something else that is equally demanding in character. That something else will likely involve attempting to address the needs of their dependents within a very tight set of time constraints. It makes good sense to address the soldier's requirement to conduct personal business as an integral part of overall work plan. Done carefully, this will facilitate rather than retard work completion. A soldier

who is not distracted by competing demands, who has reasonable assurance that all that is necessary will get done, will do a better, faster job.

The single greatest impediment to the establishment and practice of effective Sleep/Rest Discipline (SRD) is an uncritical "gung-ho", "can do", "Superman" attitude. It is this attitude that causes a leader to worry about resting his troops while forgetting to rest himself. It is this attitude that causes a leader to delegate tasks properly and then improperly stay awake to see that they get done. In the history of medicine, there are a handful of recorded cases of people who apparently did not need to sleep. These people still needed to rest, still became fatigued, and tended not to live to a ripe old age. The rest of us need to sleep and rest on a regular basis. If we fail to do so, whenever and wherever the appropriate opportunity presents itself, we suffer a self-inflicted wound.

Science does not yet understand why we sleep, only that we must. The longer an individual goes without sleep, the more probable it is that he will go to sleep at the first opportunity. As the length of sleep deprivation increases, more and more periods of "microsleep" occur. This term refers to the appearance of sleep patterns in a recording of brain activity even though the individual appears to be awake. Errors are very likely to occur during microsleep episodes. Since the individual is also unaware of these lapses, they can lead to disastrous consequences in hazardous situations. Finally, the effort to keep awake requires increasingly heroic efforts as time passes. These efforts also expend personal resources. SRD represents a safer, more sensible and more effective course of action.

Effective SRD applies to everyone from the commander on down. Leaders function not only through the issuance of orders and directives, but through percept and example. When a sustained mode of operation is in effect, "Why aren't you asleep?", may be the most appropriate question that every soldier can ask himself and his subordinates. A full discussion of the principles necessary to organize work in sustained performance situations is presented in Appendix I.

## PEER AND DEPENDENT SUPPORT SYSTEMS

The social problems associated with the rapid deployment of a large body of troops are directly related to the social structure of the modern Army. Over half of all troops are married. While the proportion of married soldiers increases with grade, an historically large proportion of soldiers in the early grades are married. Since young soldiers are newly married, they have not been married long enough, or been in the Army long enough, or for that matter lived long enough, to have acquired an extensive repertoire of life coping skills. Such skills are needed to handle the dislocations common to Army life. Without effective social support mechanisms, these soldiers and their dependents are prey to a variety of stressors.

The needed social support has its sources in an individual's relationships within:

1. The immediately present family.
2. Friends in the community and workgroup.
3. Family and friends located elsewhere.
4. Informal support groups based in the military and civilian communities.
5. Formal support groups based in the military and civilian communities.

These groups act to provide both tangible and intangible support to individuals as they cope with the good and the bad things that happen to them. We have arranged the list so that the further down the list you go, the more remote the groups are in terms of the immediacy, intensity, and effectiveness of the support they normally offer. When there are difficulties with, or inadequacies in a particular support group, those lying above or below it can provide some measure of substitute support. Support from above is generally superior in both quality and quantity to that which can be provided by groups lower in the hierarchy.

We suggested above that there are problems associated with young, inexperienced, Army families faced with the stresses of rapid deployment. We do not intend to convey that this is the only source of stress for such families. They are most often separated from family and civilian friends. They experience severe economic difficulties. If, as is commonly the case, they live off post, the housing conditions are very likely to be physically inadequate and lacking in community social support mechanisms. They are very likely to be isolated from social service support mechanisms in the military community. In short, the social situation faced by many young soldiers and their dependents is a prescription for trouble at any time. The prospect of deployment can readily act as a lens through which these general problems are focused in time and space onto the deployment preparation phase.

Once the actual separation of the soldier from his or her dependents occurs, physical distance tends to create psychological distance so that the situation more closely resembles historical experience. However, modern communications technology can shrink psychological distance to that experienced when you talk to someone on the phone. Satellite communications makes that call home available just about anywhere in the world. Problems at home can now follow the soldier into the field with an immediacy never before possible. There is evidence that this level of contact will add significantly to a soldier's stress load.

We are suggesting that the problems outlined above are built into the structure of contemporary society and concentrated by the structure of the Army. They are further concentrated by the need to conduct rapid deployment operations. We most emphatically do not suggest that the commander and his staff can cure these problems. The capacity to effect that kind of social change lies far beyond his scope and purview. We do suggest that there are concrete actions that can be taken which will lessen the severity of the problem.

The advice given below falls into one of two categories: that which addresses the general issue of improving the quality and availability of social support systems; and, that which addresses the mobilization of these systems during the preparation for deployment. There is wide variation in the social and physical organization of posts in terms of the availability and patterning of on and off post housing. Rather than attempt to speak to this entire

range of variation, Appendix II provides checklists of questions that provide the framework for an examination of the situation on a particular post. While the answers to individual questions may not be easy to acquire, the effort involved in providing honest answers will furnish a clear picture of how well the general social and social service environment supports soldiers in the performance of their duties.

We believe that the effort expended will pay handsome dividends before, during, and after deployments. The benefits will be felt in terms of improved morale and a reduced incidence of the poor performance consequences of low morale. We do not believe that massive new programs are necessary, or even particularly desirable. A great deal can be accomplished through problem area identification, redirection and sharpening of available resources, and the extensive involvement of target groups in cooperative self-help efforts.

The necessity of involving target groups in the solution of their own problems merits further comment. The formal inventory of support services delivery organizations in a given community may be found to cover all areas of identified concern. The personnel responsible for the delivery of those services will likely be both dedicated and overworked. In spite of this, there will be a general perception that the job isn't getting done. The key term here is perception. If we don't perceive that we are being supported by family, friends, and community, then the realities of the situation are not likely to affect our behavior in constructive ways. The perception of social isolation is a source of extreme personal stress.

If, however, we are involved, face to face, with other people who seem to have the same problems; if we have a chance to share information and learn from one another; if we can help one another with transportation, shopping, and child care; and if we can develop some sense of connectedness with "the system", then it becomes more difficult to maintain that perception of isolation. Personal involvement acts as a force multiplier for organized and official efforts that extends the reach and effectiveness of available resources. There are "costs" associated with the creation of dependent support mechanisms that work. Given a voice, new groups will speak and what they have to say may be uncomfortable. However, the benefits far outweigh such "costs."

## CONTINUING MEDICAL ACTIVITIES

Soldiers and their dependents do not stop needing medical services just because a portion of those services are packing up in preparation for deployment. We suggest instead that patient loads are more likely to increase as a result of changes in the nature and intensity of activities in the communities serviced.

Stress and fatigue alter the immune competence of affected individuals and render them at greater risk for common infectious diseases. Stressors also operate to lower an individual's tolerance of the normal discomforts that accompany common infectious diseases. Therefore, during preparations for deployment, soldiers are more likely to experience mild illness and it is more likely to bother them. Given the fact that working conditions are tough, this is a perfect situation for patients to experience secondary gains from work avoidance through illness behavior. This is a normal behavioral process that must be distinguished from outright malingering. Rates of malingering can be expected to increase as well. Both remove soldiers from the workforce and increase patient loads.

The occurrence rates of errors of commission and omission increase when soldiers are fatigued and stressed. Things are done which should not have been done, and other necessary actions and precautions are not taken. When these errors are associated with the use of machinery, they are likely to cause accidents and attendant personal injury. Increased rates of personal injury remove soldiers from the workforce and create increased patient loads.

There are many reasons for permitting an immunization maintenance program to "slip" during periods of normal operation. All of these reasons fly out the window upon receipt of notification to deploy and it becomes a matter of priority action to update everyone's shot record. Considerable time and effort must be expended in reviewing records, hunting everyone down, and shooting them with one, or more, of the appropriate vaccines. And, since time is of the essence, these patients might just as well get everything they need at one time. This practice constitutes both an error of omission (not doing it before), and an error of commission (doing it now). It unnecessarily increases the workload of the people who must deliver the immunizations, at a time when they have better things to

do. It unnecessarily disrupts the workforce, at a time when they have better things to do. Finally, shot reactions are very likely to react synergistically with fatigue and stress and make recipients sicker than they would normally be.

The more persuasive and effective you are in providing consultation and support in planning and practicing for deployment, the lighter your patient load will be when you are preparing for that same operation.

There is a common mythology about health care professionals concerning their invulnerability to the ravages of fatigue and stress. As an occupational group that must of necessity do shiftwork, there is an unfortunate tendency to act on that mythology and establish counterproductive work schedules. Do not set bad examples.

There is much more than a passing relationship between the medical doctrine appropriate for deployment and that appropriate for combat. The serious problems in both tend to be acute and situational. The goals of casualty minimization and early return to duty are the same. In the context of deployment this means understanding fatigue and stress processes, preventing or reducing them when possible, and intervening effectively when they occur.

#### PRELIMINARY DIETARY COUNTERMEASURES

We are just beginning to understand the operation of a set of biochemical processes that link together what we eat with short term changes in the balance of certain important brain chemicals. It now appears, for example, that a meal rich in carbohydrates will, within 30 minutes, increase the amounts of a brain chemical that is associated with sleep states. Similarly, a meal that is rich in protein will increase the amounts of another brain chemical that is associated with awake and active states. We are also beginning to understand more about the impact of coffee, tea, and alcohol on the synchronization and desynchronization of the biological rhythms that we discussed earlier.



While this body of knowledge is far from complete and still subject to controversy, there is enough evidence available to suggest some dietary interventions that may help soldiers adjust to new work schedules and time zones. These interventions do not involve the introduction of new foods, but do involve altering when certain normal classes of food and drink are available and recommended for consumption. We believe that these interventions are safe. At worst, they are no poorer than the normal free-feeding patterns of soldiers.

Even if we take the most conservative dietary position and assume that the feeding modifications described below will have no biochemical effect, we cannot discount an important behavioral effect. A placebo is the infamous "sugar pill" of medicine that has its effect on patients through psychological mechanisms. The effect is real even though the medication may not be, a fact that physicians have used successfully for centuries. The reorganization of feeding schedules and patterns can exert a powerful placebo effect on those involved. Since we have adopted the strategy of attempting to tip the odds in our favor, we include the following recommendations.

Meals are major social and biological events in the lives of all peoples. When people eat and what they eat exerts powerful influences on their entire metabolic system. When people eat and who they eat with are equally important factors in the organization of work and rest periods, as well as the social groupings through which social support mechanisms operate. Therefore, it should come as no surprise that meal related factors play a role in the timing of human biological rhythms.

In areas of the civilian sector where shiftwork is common it is not unusual for local businesses to adapt to the twenty-four hour availability of customers by adopting round the clock operations themselves. The most common adaptation occurs among food service organizations which cater to the eating needs of their customers.

When breakfast, lunch and supper are taken outside their accustomed time slots by shiftworkers, appropriate food choices become more a matter of the place of a meal in the daily activity cycle than simply of the time of day. If we define meals by their place in the daily activity cycle, the following holds:

1. Breakfast is a meal that starts an activity cycle.
2. Lunch is a meal that occurs near mid cycle.
3. Supper occurs in the last quarter of a cycle.

Some cultural groups routinely eat four meals a day, but the same principal holds.

The easiest way to satisfy the feeding needs of a shift working population is to adopt an urban cafeteria model in which foods appropriate to all meals are available at all hours. If the entire unit served by a particular mess facility is on the same shift schedule, then appropriate adjustments are made. The term "easiest" is used in a purely relative sense. The task of adjusting meal times and contents to a sustained operations mode is difficult. Food service personnel must be given sufficient lead time for planning and preparation.

The main principle involved in menu planning involves changing the relative protein/carbohydrate balance of meals at the start and end of scheduled activity periods. The balance is shifted to the protein side at the start of an activity period and to the carbohydrate side at the end of an activity period. This advice has to do with the composition of foods rather than with particular kinds of food associated with the three main meals. The range of foods associated with the three main meals in our culture is wide enough to permit the shifting of protein carbohydrate balance according to meal type.

We suggest a strategy for feeding under shiftwork conditions that borrows heavily from the fast food industry. It capitalizes on existing food preferences, reduces the load on food service operations and can be tailored to maintain dietary balance. The elements of this strategy are:

1. Take full advantage of local food preferences to restrict the range of menu offerings. Concentrate on foods with high acceptance. Individuals faced with sudden adjustment to shiftwork will accept highly preferred foods more readily.

2. Concentrate on foods with short preparation times, foods that can be pre-prepared, and foods with a long presentation life.

3. Within the restricted range of offerings, present foods that are culturally acceptable for the main meal types.

4. Disseminate the information about appropriate protein/carbohydrate balance widely among the troops during training in rest/activity discipline.

5. Reinforce that training by labeling foods in the mess lines. The labels can be as simple as "P" or "C" stickers. A trooper should have more "-Ps" than "-Cs" on his or her tray going on shift and vice versa coming off shift.

#### DRUGS

Earlier, we discussed the fact that protein/carbohydrate balance affects the availability of substances that affect brain states and alter our readiness for activity or sleep. We also routinely ingest a number of other substances that affect both brain chemistry and the organization of biological rhythms.

The substances we will discuss are:

1. Liquor, beer, and wine.
2. Coffee and cola drinks.
3. Tea.
4. Prescription and non-prescription drugs.

While members of the first three groups are not commonly thought of as drugs, each has profound effects on the central nervous system. The active pharmacological agent in the first group is alcohol, a powerful nervous

system depressant. The agent in the second group is caffeine, a moderately powerful central nervous system stimulant. The agent in the third group up is theophylline, a slightly less potent stimulant than caffeine.

If used in heavy amounts, the sudden cessation of use of substances in any of these three classes will produce withdrawal symptoms. Use of these substances at times that are inappropriate to current rest/activity cycles will also have an adverse effect on performance capabilities.

The last group of substances includes all other non-food substances that people routinely put into their bodies to achieve some desired effect. They include materials prescribed by physicians, or sold over the counter, as well as those consumed for recreational purposes. While the latter group are most often associated with the "drug problem", any drug substance taken when circadian rhythms are disrupted or at unusual times during the circadian cycle can produce "problems." The effect produced by the drug may be stronger or weaker than expected.

Well-controlled social drinkers usually limit their consumption of alcohol to after duty hours. They seldom drink alcohol during the morning hours, even when off duty. This consumption pattern is so wide spread that when it is violated, it is considered to be diagnostic of alcoholism. Coffee tends to be consumed during the first half of activity periods. When consumed late in an activity period, its use generally follows a major meal.

Cola drinks are likely to be consumed throughout waking periods. Their use often substitutes for coffee during the latter part of the day. In addition to caffeine, cola drinks and most other carbonated beverages are a significant source of highly refined sugar. Individuals who are concerned about the amount of caffeine they are consuming often do not take soft drinks into account as a significant source of daily intake of this substance. The amount of sugar in soft drinks should be accounted in considerations of protein/carbohydrate balance.

In our culture, heavy consumption of tea is less common and does not show the same strong temporal organization of usage patterns. However, because tea has fewer nasty gastrointestinal side-effects, many people are using

it to replace coffee during the second half of their activity periods. The active chemical ingredients of tea are closely related to those of coffee and must also be accounted when considering levels of caffeine consumption. Heavy alcohol and coffee consumption tend to go together as user attempt to adjust the depressant and stimulative effects.

The problem with these substances that must be dealt with forthrightly is the heavy user. As we have stressed repeatedly, shiftwork and sustained operations disrupt the internal organization of biological rhythms. Going "Cold Turkey" from alcohol and/or caffeine in an excess of zeal will cause more problems than it will solve. The withdrawal symptoms of malaise, fatigue, and negative mood are the same as those accompanying major shifts in activity pattern. We have every reason to believe that the symptoms from the two sources will compound in their effects. Instead of going "Cold Turkey", detoxification should be accomplished by a planned program of "tapering off" during the early portions of the deployment preparation phase.

Drinking alcohol and coffee are integral parts of our social lives in the sense that we do both in the company of others. The fact that solitary drinking is considered to be diagnostic of alcoholism illustrates the importance of social factors in consumption of these substances. Since our goal is to minimize disruption, the tactic to adopt for "tapering off" is to reduce the quantity of the physiologically active agent that is being consumed successively over time. In the case of alcohol, that means fewer drinks, or weaker drinks, or both. Remember, it is the ounces of alcohol consumed that count, not the form in which they appear. Beer and wine drinkers take heed.

In the case of coffee consumption, "tapering off" is best accomplished by the substitution of decaffeinated coffee. While it is possible to reduce caffeine intake by alternating between the two kinds of coffee, it is more effective to simply mix them together in appropriate proportions. This works equally well with coffee prepared by the urn, the pot, or from jars and packets of instant coffee. The heavy user of cola and other carbonated beverages has a more difficult problem. The sugar load can be reduced by substituting diet beverages. The reduction in caffeine can be accomplished by switching to noncaffeinated soft drinks or to fruit juices.

While there are no hard and fast rules for just how quickly the tapering off should be done, a useful approach is to halve the quantity of alcohol and caffeine every five to seven days. The rate can be easily self-adjusted by an individual in accordance with the strength of his or her habit and response to withdrawal.

Consume your modified amounts of alcohol, coffee and tea in accordance with your new activity pattern. While we have described consumption patterns, in general, there are individual variations. Adjustment is an individual matter. However, mess facilities, snack bars, and clubs should support individual efforts by posting reminders and making alternatives available.

We cannot provide more than the broadest guidance in the area of prescription and non-prescription drugs due to the staggering array of drugs that people routinely consume. It is now well known that the effect a particular drug has on the body is highly likely to be related to the point in the circadian cycle at which the drug is taken. Equal amounts of a drug taken at different times of the day and night may have significantly different effects in the sense that the drug action produced might range from one-tenth to ten times that expected from the "normal" dose. Drug dosages are most often specified in terms of their being taken at "normal" times of the day.

As indicated earlier, the rapid deployment situation is one in which there is no longer a biologically normal time of day that can be counted on for predicting drug effects. This is not only true of the main drug effects, but for the usually undesirable side effects as well. Matters are further complicated by the fact that people take more than one drug at a time or take them in a manner that causes more than one drug to be circulating in the body at the same time. Drugs interact with one another and may reinforce, weaken, or otherwise change the impact of the drugs being taken. These drug interactions are also likely to be altered by changes in the structure of an individual's biological rhythms.

In the case of prescription drugs, medical advice should be sought. Since it will be extremely difficult in most cases to specify the relationship between a given drug regimen and the alterations in biological rhythms, the most useful advice will deal with side effects and changes in dosage that should be instituted should the side effects occur.

Non-prescription and recreational drugs should be approached with extreme caution. Drowsiness, for example, is a common side effect of many cold remedies. An unexpected increase in drowsiness associated with taking a simple cold remedy could easily increase the risk of an accident. Either stop taking the drug, or greatly reduce the amount you are taking. If you choose the latter option, you can gradually increase dosages to safe levels.

The problem is that you will be experiencing a range of symptoms associated with the alteration in your biological rhythms. Some symptoms may be caused by the altered effect of the drugs you are taking, others by the altered rhythms themselves. It is unlikely that you will be able to sort out the causes of your symptoms with any precision. However, drug ingestion is a voluntary act on your part that can be controlled. Therefore, the simplest action that can be taken is to alter your pattern of drug use.

#### PREPARING FOR EMBARKATION

We are now down to the wire, a day or two before loading troops on the aircraft and leaving. If the preparation plan was done and executed in good form the following conditions should hold:

1. All critical tasks involving the greatest number of personnel have been accomplished. The exception will be those exercising command and staff functions. Everyone is in reasonably good shape. Morale indicators have not taken a nosedive. The number of personnel who have managed to absent themselves from the operation is minimal.

2. The social support network has done its job. Most people have their personal business under control and those about to deploy have some assurance that their personal lives are not going to unravel as soon as they board their aircraft.

3. People have changed the way they eat and drink. Their meals are lighter and more appropriately structured to their physiological needs. Alcohol and caffeine con-

sumption have dropped to the point where going "cold turkey" will present no problems with withdrawal symptoms.

This happy state of affairs clearly calls for a loud round of self-congratulation and a chorus of "well done!". The one thing that it does not call for is a party. The bon voyage party was a great tradition in the days of the steamship. In the days of rapid deployment, it is no more or less than breaking training just before the big game. The training rules are:

1. Get what sleep you can. If you can't sleep, get what rest you can. Remember, rest can be active as well as passive and light physical and social activity is acceptable. On the day of departure, avoid taking naps during the day. If your flight leaves in the late afternoon or evening, there will be a scheduled sleep period during the flight.

2. Abstain from alcohol and caffeine. Aside from what these substances do to an individual's biological rhythms, a hangover during a jet flight interacts with a set of environmental stressors we will discuss shortly in ways that significantly increase their impact.

3. Eat lightly in small meals or snacks on the day of departure. Avoid highly refined sugars and satisfy your sweet tooth with the more complex sugars present in fruits.

Movement from garrison to a point of departure is the first step in embarkation. It is a simple, routine operation that is similar to innumerable other road movements accomplished by units. However, this simple operation can serve to illustrate one common conflict between normal Army organizational behavior and the requirements associated with maintaining performance capacity in sustained operations.

We start with a requirement to assemble troops in a specific place, at a specific time, for a specific purpose. Being late is not an acceptable outcome and there few, if any, acceptable excuses. Everyone in the chain of command understands the requirement and appreciates the contingencies. They are all good soldiers. As good soldiers, it is virtually impossible for each of them to refrain from building a little insurance into the schedule for their subordinates. It's important to beat Murphy's Law.



If this process is permitted to operate without effective command control, there is a real danger of creating a disconnection between what people should be doing and what they are actually doing. In the contexts of deployment and sustained operations, soldiers should not only be doing their jobs, but conserving their performance reserves as well. Left unchecked, the "hurry-up and wait" syndrome will most likely leave soldiers standing around waiting for something to happen after having been rolled out of the sack and mustered hours ahead of time. This process is so common that it is the basis of a cliché about Army life. As such, its operation is very likely to be transparent to command unless carefully attended to and controlled.

Treat time as the precious and irreplaceable commodity it is during a deployment operation. We have outlined the steps necessary to organize work and rest in Appendix I. Following those steps to create a workable plan and putting it in operation is a major effort. It would be a great waste to have that effort subverted in any way by a tired, old cliché.

Breaking the power of the "hurry-up and wait" syndrome is a top-down operation. Subordinates in the chain know well what their superiors expect, recognize, and reward, and they behave appropriately. In the case of sleep/rest discipline, it was suggested that not much would happen until commanders started asking "Why aren't these people asleep?" We suggest that commanders also ask "Why are these people standing around?"

#### EMBARKATION: SHELTER AND REST

Airfields are not very friendly places for troops to spend much time. By necessity, they are open and exposed to the elements. That warm, friendly sun back at the barracks is likely to turn into a broiler at the edge of an airstrip. That gentle breeze is likely to blow your socks off when there is nothing around for a few miles to break its flow. Some rain, or snow, or cold will make the environment downright hostile very quickly.

The is a body of common belief that holds that soldiers exposed to the elements will be hardened and improved by the experience. It is often believed that exposure will cause them to adapt physiologically and become inured to lousy weather. Unfortunately there are enough grains of truth buried in a pile of untruth to support what is essentially a myth. Actions based on this myth degrades performance capacity and increases the risk of producing unnecessary casualties. The guidance given below will briefly review the relevant facts and provide references to more complete information. The realities of adaptation to environmental stressors are:

1. Heat: While soldiers do adapt physiologically to the heat, acclimatization is only about half complete after one week and three-quarters complete after two weeks of progressively graded exposure. Sleep deprivation, fatigue, dehydration, and age are some of the factors that increase the risk of heat injury. If deployment is to a hot climate, acclimatization should be started well before soldiers are mustered on the airstrip. Heat casualties are hard to justify at that point in time. See TB MED 507 Prevention, Treatment, and Control of Heat Injury for further information.

2. Altitude: Soldiers do adapt physiologically to high altitudes. The symptoms of acute mountain sickness are generally lost in a week, but adaptation continues over a period of months and perhaps years. While high altitude is not a departure problem, it does create several in-flight problems that will be discussed later. If high terrestrial elevation is a feature of the terrain in your upcoming area of operations, see TB MED 288, Medical Problems of Man at High Terrestrial Elevations.

3. Cold: Not only do soldiers not adapt physiologically to cold, but even mild prior cold injury will very likely sensitize an individual to new exposures. The cold soldier is uncomfortable, at risk for preventable injury, and accumulating fatigue at a high rate. The first line of defense against cold is avoidance of exposure. Failing that opportunity, proper training, proper clothing, and the exercise of cold discipline are the only defenses. If cold is a feature of the environment to which your unit is deploying, see TB MED 81, Cold Injury.

4. Wet: Being wet, by itself, is not an acute environmental stressor. In fact, people tend to spend sizeable

amounts of time, money and effort getting wet. Being wet, when combined with heat or cold, is another matter. In dry, desert heat, being wet aids evaporative cooling. In humid, jungle heat evaporative cooling hardly works at all. In the cold, being wet destroys the insulating properties of most clothing and promotes hypothermia and cold injury. These factors are discussed in the previously referenced TB MEDs. Continued wetness alters the characteristics of skin and renders it more susceptible to chafing injury. Being dry is clearly desirable from a comfort and health standpoint.

What soldiers do gain from exposure to environmental stressors is the opportunity to practice and perfect what they learned in training. If exposure is inevitable, all necessary precautions should be practiced. Empty hangers offer considerable floor space and shelter from sun, rain, and snow. The use of hangers as shelter is a reasonable subject of negotiation during pre-deployment preparations.

We have been following two general strategies for coping with the negative biological impact of the stressors associated with long range rapid deployment. The first involves actions designed to reduce the effect of stressors by removing or reducing them. The second strategy involves actions that will hasten adaptation to the conditions that will prevail at the destination. Up to this point, we have placed the greatest emphasis on removing and reducing stressors. The strategic balance will now shift to hastening adaptation.

Many international pilots, who routinely face the problem of rapid changes in time zone, have adopted the tactic of always staying on home time. They ignore in so far as possible the altered time cues at their various ports of call and eat, sleep, and play at times appropriate to home base. Soviet pilots, as a matter of rule and regulation, live on Moscow time and their system is designed to support that schedule. This option is not available to deploying troops. Therefore, the most reasonable course for troops to follow is to adapt to local conditions as quickly as possible.

Pilots use such factors as sleep time, meal time, and social time to help them maintain their biological rhythms on home time. These same factors can be manipulated to hasten the adaptation to destination time.

Ideally speaking, destination time should be adopted by troops well ahead of the actual deployment so that maximum pre-adaptation can occur. We have rejected this option as being totally unworkable in terms of the numbers of people involved and the complexity of the tasks that they must accomplish. The first time when deploying troops are likely to be all together, in one place, with nothing better to do, is when they arrive at the point of embarkation. We strongly suggest that this be the point at which everyone adopts destination time and guides all future actions accordingly.

We have repeatedly stressed the degree to which we govern our lives by the clock. In man, the clock appears to have assumed a greater role in the control of biological rhythms than the succession of day and night that times the rhythms of lower animals. While it is not the clock itself that controls but what we do that is important, resetting the physical clock has symbolic significance. It should be done by groups as a group in order to provide a clear synchronizing signal.

Once all of the clocks have been reset all subsequent actions should be appropriate to the new time zone, to the extent that that is possible. These actions should be taken as a group. When rest is called for, all rest. If activity and exercise are appropriate, everyone plays. No one falls out to catch a quick nap. The discipline that is appropriate to a road march should be exercised.

Unit leaders should be creative in devising structured, group activities during what would be the duty day on destination time. Whatever activities are chosen, they should not be of the "painting white rocks" variety. Nor should they be of the "listen-up, you people" variety. The activities should be related to the business at hand and they should involve the collective participation of the group. An active question and answer review of the drill to be followed on the aircraft would be a useful exercise.

#### EMBARKATION: DIETARY DISCIPLINE

The fact that the human body is mainly composed of water is common knowledge. The fact that all of that water

is very highly organized in terms of its distribution within cells, between cells, in the blood, etc., and the fact that the body goes to truly extraordinary lengths to maintain that organization within very tight tolerances is less well appreciated. There is an extremely complex exchange system within the body, and between the body and the environment, whose sole purpose is to keep the water account in balance. When any of the elements of this exchange system fail to maintain the balance, for any internal or external reason, a wide array of body functions are disturbed and their integrity is threatened.

Since we are dealing with healthy young and middle-aged individuals (no one else gets to go), we will ignore all of the many water balance problems that accompany illness and disease and concentrate on those that are commonplace in military operations. The main sources of difficulty are:

1. Fluid availability. The maintenance of adequate supplies of water is a basic tenet of military doctrine that should require no comment. Yet, it is remarkable how much trouble people who should know better get themselves into by not correctly anticipating water needs. An individual can go without food for weeks, but be in deep trouble if deprived of water for a day or two.

2. Failure to consume enough. The sensation of thirst is not a reliable indicator of the body's state of water balance. It can significantly lag behind the development of a negative water balance, i.e., state of dehydration, and it can be masked by psychological factors. Water consumption normally falls during times of stress and the soldier in combat, for example, is routinely dehydrated. Even without stress, the pressure of events and pace of activities may make drinking water a low priority behavior. Leaders must actively push water on troops during even low key operations. Troops on a road march, in moderate weather and practicing good water discipline, most likely end the march in a state of negative water balance.

3. Drinking the wrong thing. Alcohol, caffeine, and theophylline actively promote water loss from the body in the form of increased urine output. A moment's thought reviewing your own personal and social experience should convince you that this is the case. Individuals can take in sizeable amounts of fluid containing these drugs, and end up rather quickly losing more water than they ac-

quire. This is a very important source of our recommendation that the consumption of these substances be limited prior to and during deployment.

4. Heat. We have discussed heat stress earlier. This is just a reminder that high ambient temperatures are a major cause of water loss.

5. Physical exertion. We can think of this cause of water loss as internal heat stress. The use of any muscle systems generates heat and the amount of heat generated is proportional to the number of muscles used and the intensity with which they are used. The body disposes of this excess heat through respiration, by moving it to the skin to increase radiation, and by sweating to create the conditions for evaporative cooling.

6. Decreased humidity. Low humidity increases the amount and rate of water evaporation from the skin surface and thereby improves an individual's ability to shed a heat load. Efficient skin cooling can reduce water loss through sweating. However, low humidity greatly increases the rate of water loss from the lungs that occurs as we breathe. This occurs even while an individual is sitting quietly in comfortable temperatures. High altitude increases the rate of water loss during respiration. We have just described weather conditions inside a modern jet transport.

These six causes of water loss act singly and together. The greater the number of factors present, and the more intense they are, the greater the rate of water loss and, consequently, the greater the amount of water that must be replaced regularly to avoid dehydration. While it is possible to write an equation that would permit one to plug in a set of values and predict the rate of water loss fairly closely, few people would use it.

We strongly recommend consumption of at least 16 to 24 ounces (2 to 3 glasses) of fluid every four hours during the embarkation period and during the flight. Those ounces of fluid should not contain alcohol, caffeine, or theophylline. That is going to seem like an awful lot of drinking, but it really isn't. Besides, if you should consume fluids beyond your needs, the body has an efficient method of disposing of it. Incidentally, as part of your planning, make sure that there are a sufficient number of sanitary facilities available at the airfield and on the aircraft.

The feeding guidance during the embarkation period is simple: feed very light meals on destination time. The composition of the meals with respect to protein/carbohydrate balance should be appropriate to the destination time activity cycle.

#### IN-FLIGHT PROBLEMS

Much of what has been discussed to this point has application in support of operations other than long-range rapid deployment. Actions taken to improve military social support systems are generally useful in the improvement of morale and cohesion. A sustained operations requirement can occur in many forms and the material on shiftwork has general applicability. The breadth of the number of topics covered in an examination of the human problems associated with deployment is an indicator of the range of issues involved in what has come to be called the "soldier dimensions problem". Now, we must turn to a specific man/machine interface problem and examine what happens when a particular piece of machinery, the jet transport, impacts upon an ancient military problem, troop deployment.

We cannot stress too strongly that the problems encountered in flight are created and conditioned by the technical characteristics and capabilities of the aircraft itself. If all military air transports flew at supersonic speeds, the human problems would change significantly. If airframe construction materials changed radically, a different significant change in the man/machine interface would occur. Therefore, the guidance given below must be tailored to particular aircraft and, even more specifically, particular aircraft configurations.

The particular aircraft that your unit, or elements of your unit will be deploying probably represents the luck of the draw. It can range from a commercial airlines "Queen of the Fleet" to a flying box car in which people are stuffing to fill in the gaps around the hardware. It is critical that the features of the aircraft that you fly in not come as a surprise at the top of the loading ramp. Familiarity with the possibilities and a set of contingency plans to cope with the reality are integral parts of planning for deployment.

Imagine that we are located out in space directly above the earth's North Pole looking down. Half of the earth's globe would be lighted by the sun and the side facing away from the sun would be in the darkness of the shadow cast by the earth itself. The earth turns one complete revolution every twenty-four hours and from our vantage point in space we see that every point on the earth passes through the line separating light and shadow twice a day (we are ignoring the complication added by the earth's axis being tilted with respect to the sun). When a point on earth moves from shadow to light, the folks on the surface call it sunrise. When they move from light to shadow, they call it sun set.

If we were to take off in fast jet from point on the equator precisely at sunrise and fly due West at 1671 kilometers per hour, we could fly until our fuel ran out, land, and find that it was still sunrise at the new air port. We would have lengthened OUR night by the number of hours spent in the air, but we would still have a full period of daylight ahead of us. We would have lengthened our light/dark cycle.

If, on the other hand, we flew our jet due East at the same speed, we would be flying away from the sunrise and toward the sunset line. On landing, we would find that we had cut OUR light/dark cycle just about in half. Thus, flying to the West lengthens your day, and flying to the East shortens your day.

When we discussed rolling schedules in the section dealing with shiftwork, we pointed out that when successive activity periods came earlier in the day, they had a greater negative impact than they did when they came later. It is the generally reported experience of travelers that flying East causes them more problems with jet lag symptoms than does flying West. We believe that these two phenomena are closely related to one another in the sense that a lengthened day creates less desynchronization than a shortened day.

The length of a flight is, of course, related to how far you have to travel, and that determines the time zone shift that you will experience after landing. However, you cannot begin to experience the effects of a time zone shift until it has happened. It is our strong opinion that what happens to individuals during the flight has a great deal to do with what they experience later on the ground. We



believe that packing a jet transport full of troops and flying them in a circle around the airport at 35,000 feet for 12 hours would produce significant symptoms of "Jet Lag". Travellers who have made long North/South flights provide some anecdotal evidence in support of this contention. Unfortunately, such control studies have not yet been done.

It is also the case that stressors interact and the more of them you face, the more trouble you are likely to be in. The longer the period of time that you are exposed to a given set of stressors, the less likely it will be that your body will cope adequately with a new set of problems. We believe that these are the important factors in determining the relationship between the length of a flight and the time zone shift that occurs at its end. Hence, the heavy emphasis we place on reducing in-flight stress levels.

Assuming a CONUS point of departure, westbound deployments will be longer than eastbound deployments. They are also likely to involve more stops for refueling, crew change, etc. Therefore, the reduction in the difficulty of adapting to a lengthened day will be counterbalanced, or exceeded, by the difficulties created by increased exposure to aircraft stressors. Rigorous adherence to the countermeasures is important for flights in either direction. Because of the increased time spent in the aircraft on westbound flights, extra effort should be made to reduce the impact of in-flight stressors.

Expect anything from First Class commercial conditions to web seats in aluminum pipe frames. Galleys and sanitary facilities may be distributed throughout the passenger space or there may be only one comfort pallet reachable only by traversing the maze of piping that makes up the P4 configuration. There may be an adjustable air vent over each seat and environmental control outlets throughout the space. On the other hand, there may be only a few heat outlets scattered throughout so that troops directly in the air stream are overheated and those three feet away freeze. The problems associated with this range of variation in configuration are:

1. Crowding which prevents movement within the passenger space for the purpose of food and fluid distribution, sanitation, the improvement of blood circulation and the reduction of muscle cramps.

2. Seating discomfort that hampers sleep and encourages the pooling of body fluids in the legs, poor blood circulation and muscle cramping.

3. Poor temperature control.

4. Poor lighting control.

The pressurization that can be maintained in passenger cabins ranges from 6000 to 7000 feet of altitude. This is a stressor that you must live with. It is also the altitude range at which one begins to see some behavioral deficits. We are dealing with a threshold effect so that not all individuals will experience any, or all, deficits, not will they experience the same severity of deficit. The types of deficit to expect are:

1. Increases in irritability.

2. Difficulty in sustaining attention.

3. Deterioration in short term memory (the memory that permits us to retain a phone number long enough to dial it).

4. Some increase in clumsiness.

If these sound like the kinds of deficits experienced as a consequence of fatigue, and biological rhythm disruption, they are quite similar. In fact, if fatigue is present, the exposure to these altitudes will increase the number and severity of symptoms.

These are precisely the kind of behavioral deficits that increase the difficulty of obtaining and maintaining cooperation in the application of countermeasures. They also set the stage for a nasty positive feedback loop. "When people don't pay attention, make dumb mistakes, forget what they were just told and then have the gall to get nasty about it, that really makes me angry!" Getting angry will increase the impact of altitude and around we go in cycles of escalation. Since a given individual will be unaware of his or her own deficits, but observe them readily in others errors in judgment about causes and effects are highly likely.

It is important that all individuals understand, as a group, what is happening to them so that they can assign blame for the irritating things that others do to the proper source. Given a reasonable alternative explanation for the lousy behavior of others, it is easier to exercise patience and self-control, and to make the extra effort that will break the feedback loop.

#### SUPPORTING THE COUNTERMEASURES IN-FLIGHT

Our strategy will be to use every practical means to establish and support a destination time zone activity schedule for the entire group. If your chalk flies at night (destination time), the task is relatively simple. Lights out at, or as soon after 2200 as possible. Cover all windows using shades if provided or other effective blackout material that you have thought fully brought along. Distribute blankets and pillows to provide stimuli strongly associated with sleep. Again, either the carrier provides, or you provide. Thirty minutes before lights out, distribute a 100 mg Dramamine tablet to each individual. Maintain quiet among the troops and that's it for the next eight hours.

Dramamine is an over-the-counter medication that is usually taken to prevent motion sickness. It also has a mild soporific action so that one of its side effects is to make you sleepy. We selected it, rather than a stronger sleeping pill because you will be able to wake up readily with no sedative hangover. It will help prevent any airsickness which, for us is a desirable side effect. Dramamine was used by the Flight Surgeon on the IDF's Entebbe raid to put his green troops to sleep during the flight. It worked well then and has since proven itself to be effective in our Army studies. Two cautions about its use:

1. Don't hand it out ahead of time. Half the pills will get lost by the time they are to be taken. Also, taking them as a group will make them more effective.

2. Don't take them if your sleep period will be shorter than five hours. While there is no danger in doing so, we will try to optimize wake-up at 06000 (destination time) and a soporific circulating in the body won't help.

Reveille at 0600. Lights on. Shades up. Stow sleeping gear. Spruce up. Serve breakfast. All of these activities signal the start of an activity period. They should take about an hour to complete. You now have a plane load of reasonably bright-eyed and bushy-tailed troopers and an indeterminate number of hours to go before the flight is over. The next issue that must be dealt with is what to do until the plane lands.

Normal air line passengers talk, read, drink, watch the movie, nap, and the occasional business man works. They do these things as individuals, they do them at the wrong time, and, as we have seen, many things should not be done at all. The smart, seasoned traveller also makes the best of a limited set of opportunities to get up, stretch and wander around. Again, he does this as an individual. In the deployment situation, opportunities for exercise are likely to be severely restricted and we want to do things as a group to promote adaptation.

A well thought out, planned, and practiced set of isometric and buddy exercises that can be done while seated, or standing near the seat is highly desirable. Particular attention should be paid to exercising the large muscle groups in the lower back and abdomen and the legs. Tension exercises should be well mixed with stretching and relaxation exercises. The goal is to prevent and reduce cramping and to improve circulation by preventing the pooling of fluids in the lower extremities. The exercise program should be a coordinated group activity. If aisle space is limited, one group can be standing and stretching while those who are seated do isometrics. Ten to fifteen minutes of every activity period flight hour should be set aside for exercise.

Maintaining good physical tone will promote and maintain a state of relaxed alertness. If combat is the goal of the deployment, then the emotional status of the troops must be considered. Historically, troops generally had weeks to accomplish the transition from garrison to combat status. We are looking at days and hours to make the same transition. We make the assumption that almost all of the troops will be untested in battle and therefore highly dependent upon their perception of the quality of their preparation for the confidence they will need to make the transition in good shape.

There is nothing that can be done during the flight to replace training and preparation that has not occurred. However, mental activities can be conducted that support and reinforce the perception of competence and confidence. Mental activities should focus on the known and the familiar aspects of the mission that constitute the next step in the deployment process. The old cliché that advises "One day at a time!" is appropriate to the situation which will be filled with unknowns and threats. Group review and rehearsal of the next phase of the countermeasures could be an appropriate starting point for all. Specific technical details of equipment unloading and preparation, or retrieval of pre-positioned stocks are good subjects. Whatever you decide to do should be group-based, focussed on the immediate and knowable future, and action oriented.

Light meals should be served on destination time. The protein/carbohydrate balance should be appropriate to the next rest or activity cycle. This may mean serving a dinner when breakfast would be the appropriate meal on home time. However, if the countermeasures have been rigorously followed, such apparent discrepancies will be expected and understood by the troops. If the meals have been selected from a group of preferred foods, there will be a high probability that they will be consumed. When selecting menus, attention should be paid to both fiber content and the flatulence producing capabilities of the foods that are served. The goal is to reduce the incidence of gut cramping that is likely to accompany stress-related increases in gastrointestinal activity. Milk should be available at meals eaten prior to a sleep period because it contains a substance that promotes sleep. However, don't push milk and make sure that alternatives are available. A significant proportion of the troops are likely to be intolerant of the lactose that milk contains and therefore be subject to G.I. distress if milk is consumed. Self-selection should be provided for and respected.

This brings us back to the issue of maintaining proper fluid balance. The process of pressurizing the cabin to produce a safe altitude also reduces the relative humidity in the air to somewhere between 10 and 30 percent. At these humidities, lips dry and crack, eyeballs get scratchy, and water is lost through the lungs at a great rate. The same guidance given earlier on drinking to produce pre-hydration applies now. Water loss through the lungs is insensible because you cannot feel it as sweat or notice it as urine. Water discipline must be pushed actively if dehydration is to be avoided.

Any coffee, tea, or soft drinks that are served should be decaffeinated. No alcohol should be consumed. Water and fruit drinks are the fluids of choice. Special drinks such as Gatorade, that are sold to combat dehydration, are not necessary and may well do some harm by increasing the body's salt load. Dry lips can be prevented by the use of lip ice which will impede evaporation. Gum, lozenges, and hard candy will help with dry mouth, but should not be used as substitutes for drinking. The corpsman on board the aircraft should be equipped with a bottle of methylcellulose to use as a lubricating eye drop. Other eyedrops such as Murine and Visine are reported not to have the same desirable lubricating effect.

Thus far, we have not mentioned smoking. This omission is due, in part, to the fact that we have no reliable information concerning the effects of nicotine on biological rhythms. The main reason for delaying a discussion of smoking concerns carbon monoxide rather than nicotine. The carbon monoxide produced by a burning cigarette is breathed by the smoker and those around him. Carbon monoxide displaces oxygen in red blood cells and reduces the amount of oxygen that is transported to the body's cells. We discussed the rarified nature of the atmosphere in the plane's cabin and the fact that it skirted close to the threshold for altitude sickness. Breathing carbon monoxide can push susceptible individuals over that threshold. Smoking should be prohibited on the aircraft.

The corpsman mentioned above should be on every flight and should serve an active medical support role. The corpsman should hand out the Dramamine in order to make himself known and to lend credibility to the belief that the drug will induce sleep. The corpsman should interpret any symptoms of jet lag to the troops as an aid in gaining compliance with the countermeasures. This will also make more time available to cadre and cabin crew to do their jobs. He should wear an easily identifiable brassard at all times.

The temperature in the aircraft should be maintained between 65 and 70 degrees Fahrenheit at all times. While the foregoing had to be stated, it most probably cannot be achieved. The cabin will be hotter, more likely colder, or most likely, not at any uniform temperature throughout the space. Getting the cabin temperature into a reasonable range may be a task requiring high level liaison and a number of successive approximations.

The environment of the aircraft generally makes it easier to cool off than to warm up. Therefore, the choice of clothing should be biased on the cold weather side, even if the deployment is to the tropics. At 30,000 feet, it is cold everywhere. If temperature differentials are severe, an equitable seating rotation can be practiced. Poor circulation in the legs and feet will make problems with cold worse. The exercise program will help.

The acoustical environment in air transports ranges from bad to terrible. Both audible noise and subsonic vibrations act as low level stressors. There is nothing to be done about the vibration, but earplugs would help with the audible noise and should be used during sleep periods. If earplugs are not available, wads of absorbent cotton provide a ready, but less effective, substitute.

Crowding, as a problem, is best handled when the deployment is being planned. Any choices concerning passenger space configuration should be made in favor of the least restrictive environment. Soldiers should not be considered packing material to cushion equipment if any alternatives are available. Make the best use possible of the space that you end up with.

#### DELAYS ENROUTE

Layovers for refueling, crew change, or weather, can easily create the problem of "breaking set" by disrupting the natural flow of the countermeasures. Local folks have been known to roll out the red carpets, brass bands, and plenty of good hot coffee and donuts for the troops. The motivation and sentiment are to be appreciated, but accepting the hospitality is likely to flush many of the countermeasure benefits right down the drain. The clear guidance is to stick with the program and stay on destination time. Since that is easier said than done, it is best to avoid the problem by fully coordinating the countermeasures with the personnel at the layover points.

If the layover occurs during a sleep period, sleep in locally provided facilities that might be available. A mattress on the floor of hanger is preferable to sleeping sitting up in a web seat. Follow the planned feeding and

drinking regimen. If the layover comes during an activity period, make the most of it. Vigorous exercise out in the fresh air will do a great deal to loosen the kinks and the cramps. A good dose of fresh air accompanied by exercise will do much to reverse the effects of altitude exposure.

#### ARRIVAL COUNTERMEASURES

We've burned up a goodly number of pages moving from notification to debarkation. This section represents the end of this document and the beginning of your mission. The actions you take from this point on will be heavily dependent upon just what your mission is and how much time you have between landing and achieving full operational status. We will assume a "best case" and describe the optimal course to achieve a smooth adaptation to your new locale. We recognize that this smooth transition may not be achievable. Use the basic principles to do the best you can.

Destination time is now the correct time. Eat a hearty high protein breakfast and/or lunch. Make regular coffee and tea available but warn everyone who has tapered off caffeine that the first cup is likely to pack a real wallop. Eat a hearty, high carbohydrate supper and hit the sack at 2200. No partying, no alcohol!

During the day, be active as a group and conduct as many of your activities out of doors as possible. Be physical! Since soldiers are the subject of our discussion, these things will happen for most of the troops anyway. Older soldiers with command or staff responsibilities may have to work harder at finding the time to get outside, but it is worth the effort. Do not nap during the day or early evening even if the opportunity presents itself and the urge is overwhelming.

If you have followed the countermeasures, your troops should be in the best possible shape during that first day in country, given the circumstances. You have minimized all of the negative effects of the trip and accomplished considerable pre-adaptation. However, the residual time zone shift effects are not likely to hit before the second or third day. The most likely symptoms to appear are early



afternoon fatigue following an eastbound flight, or early awakening following a westbound flight. Roll over and go back to sleep if it is the latter. Don't take that nap if it's the former. Continued compliance with the first day regimen is your best bet to hasten adaptation. Remember, it will take several weeks to complete the process. We know very little about the effectiveness of the countermeasures in preventing or reducing the frequency or severity of medical complaints common to new arrivals in an immunologically alien environment. We suspect that rapid adaptation to the new time zone will result in improved capacity to resist attack by local variants of common infectious diseases. However, the problem does not end there. Depending upon the locale of the new area of operations, a host of new infectious disease agents may be encountered by troops for the first time. These agents may well be the first enemy met and engaged. A complete treatment of this issue is beyond the scope of the present document. We refer you to the report Proceedings of the Workshop on Infectious Disease Threats to the Rapid Deployment Force: Preventive Strategies. This report is available through: Director, Walter Reed Army Institute of Research; Washington, DC 20012.

In discussing the post-debarkation countermeasures, we have been assuming near garrison conditions for the troops. A more probable scenario involves immediate projection into a sustained operations mode for all troops followed closely by simulated or actual high intensity combat for the combat arms. Although a discussion of sustained combat operations lies beyond the scope of this document, many of the same principles that underlie this treatment of deployment also apply to sustained combat. We will briefly review two areas where the application is direct.

The first involves the impact of multiple stressors on biological integrity and performance capacity. We have broken the deployment process down into its component parts, identified the stressors associated with each component, and suggested ways of reducing or avoiding their impact. At no point did we identify THE critical stressor and THE action that would fix it. There is no single villain or single quick fix. The stressors interact and cumulate so that the sum effect is worse than the parts. The success of the countermeasures depends upon the cumulative effect of a number of small interventions which, taken singly are quite trivial. Modern, high intensity, sustained combat is at the end of the line with respect to

the number and intensity of the stressors it will lay on participants. The only reasonable approach to force conservation in that prospective environment is to ferret out every action that will conserve any portion of human capacity, make those actions SOP, and trust that in the aggregate they will sustain the effort needed to fight and win.

One important component of that aggregate of sustaining actions involves sleep/rest discipline. We believe that various forms of shiftwork will be possible in rear areas and the principles discussed above will serve to guide its development. However, for those in direct and indirect contact with enemy forces, we believe that the situation will more accurately be characterized by too little total sleep, taken in fragmentary snatches day and night as conditions permit, and taken in environments hostile to any sleep at all.

Early on, the motivations against practicing SRD will be compelling and driven by the pace of action. Later on, sleep will be compelled by accumulated deficit and physical and emotional fatigue. The early and middle periods bound the area within which the commander can maintain a critical element of control over his human resources by practicing rigorous sleep/rest discipline. By so doing, it will be possible to push the inevitable "later" off a bit further into the future and to buy some valuable time. The goal of combat SRD is a minimum of three total hours sleep per twenty-four hours, with as many of those hours occurring between 0000 and 0600 as possible.

#### APPENDIX I: PLANNING SHIFTWORK IN A SUSTAINED OPERATION

The material in this Appendix is generally useful in the planning of shiftwork since it reviews considerations that apply whenever people must regularly work outside normal daytime hours. We have concentrated on shiftwork in the military environment as troops prepare for deployment. The same principles will be useful for planning the work of support troops under sustained operations conditions whenever and wherever they arise.

Management technology has developed a number of techniques for scheduling events in complex projects. We have borrowed heavily from these techniques for basic ideas, but have deliberately left the mathematics and computer programming behind. The planning sheet described below can be a large sheet of wrapping paper, a blackboard, or a 4' X 8' sheet of plywood. The sheet of plywood with a stack of 3" X 5" index cards and a box of thumbtacks works very well. Flexibility is the watchword.

Break the work down into component task streams. Decide what tasks can be done in parallel and which must be done serially. Decide how many of what kind of people are necessary to accomplish each task and make careful estimates of how long it will take them to finish each task. First, do this analysis based on the normal work day and the normal workforce complement. Assume that everyone is going to work reasonably hard and do their jobs reasonably well. Assume that, under the conditions outlined above, you will have available to you the time necessary to complete the entire job. Lay all of this information on a large planning sheet.

The first layout that you prepare under the assumptions given above establishes your baseline work flow and sequence plan. Next, examine your unit's deployment scenarios and determine how much time you are likely to have to accomplish the same amount of work under each of the various contingencies. Go back to your baseline planning sheets and draw a vertical red line down the sheet at each time point specified in the contingency plans.

If your red lines fall to the right of your last task completion time, you are home free. Stop reading this and go on to the next section. If, however, your red lines fall to the left of your last task completion time, the amount of shortfall describes just exactly how much time you will have to make up by adopting a set of sustained performance strategies. As you consider the various strategies that will be outlined below, remember that one of your goals is to provide your people with sufficient time to clean up and organize their personal affairs.

Start simply. Analyze the impact of going to 12, 14, and 16 hour work days, seven days a week. (12 hours a day, 7 days a week describes the wartime Army work week as specified in regulation). You can get a quick idea of the probability of success using this strategy by comparing the

number of manhours of work it will yield over the time allotted for job completion with the number of manhours needed to complete the job. This comparison will tell you if the strategy will not work (that is, the redline is reached before the work is done). It will not tell you unequivocally that the strategy will work. Remember that some tasks must be done serially and a later task cannot be started before the earlier task is completed. You must test this strategy on your planning sheet.

If this maneuver moves your task completion time to the left of the redline, you can then undertake a set of refinements that will give individuals more rest time and/or time to conduct personal business. Your planning worksheet will help you identify the holes and dead-time for individuals and teams that can be used for this purpose in a flexible and creative way.

The chances are very good that the simple strategy won't do the job and that the work day will have to be extended around the clock in a shiftwork mode of operation. However, shiftwork during preparation for deployment is different than that conducted in "normal" military and civilian work environments. In the normal case, shiftwork is undertaken to provide a necessary service around the clock or because the economic and/or technical features of a production process make such operation desirable.

In the normal world of work, a shift schedule is chosen on the basis of a complex set of socioeconomic and technical factors, e.g., law, tradition, labor negotiations, etc. Whatever schedule is chosen will be the mode of work that will be expected to be in effect for some extended period of time. Staffing levels and skill mixes are determined by expected work flow just as they are for daytime work. There is ample time available for days off, compensatory holidays, etc.

The following critical constraints apply in the deployment preparation situation:

1. The available manpower pool is relatively fixed with respect to number and skill mix. Short-fuse fills and assistance from non-deploying adjacent units may help, but it isn't like calling your local employment agency.

2. The period of deployment preparation has a fixed duration with a definite beginning and end. Furthermore, the end of the preparation phase signals the start of the real job which is very likely to be considerably more demanding in terms of its human costs.

3. The amount of work that must be completed during that fixed preparation phase is, or should be, known in exceedingly fine detail. It doesn't depend upon whether a company's salesmen have been particular hotshots this month, or whether a quarter of the population shows up in the emergency room one weekend.

Examine your real T.O.E. (The one with live people filling the slots) in light of what you have laid out on your baseline planning worksheet. Try to divide your available manpower into two or three teams for each of the principal tasks that you have laid out. Each team should include the necessary supervision, skill mix and number of hands to get its piece of the job done.

Since these teams are going to follow one another as they work around the clock, each should be able to pick up where the last team left off. While an equal balance in capability between teams is the goal, it may not be achievable. Don't create a team that can't do the job just to fill out a shift schedule. They will cause far more trouble than they are worth.

If you cannot create at least two teams for a particular principal task, stick with one basic team and go back to the basic strategy outlined above. These people will have to work excessively long hours and will be at risk of becoming fatigue casualties. You should monitor them carefully and intervene with your medical resources if necessary. With three teams, you can establish a basic 8 HR-ON: 16HR- OFF schedule much like that commonly used in industry. The workday is not extended and there is plenty of time for rest and personal business. The hours of work periods are stabilized from day to day. However, the 0000-0800 shiftworkers will be operating at the lowest point in their daily cycle of biological capability.

The graveyard shift will not have time to adjust to this schedule. Their dip in performance capability that accompanies the daily circadian low will also be true for other crews working this time period under any shift

schedule. Consequently, you should plan your workloads accordingly or use your strongest team in this time slot. Conversely, use your weakest team during normal working hours when the opportunities for cross-supervision are greatest.

If you can form only two teams, the workload per team will go up and the length of rest periods will be shortened correspondingly. We will discuss three examples for the purpose of illustration. These are:

1. 6 hr-on: 6 hr-off (12 work hrs/24 hrs). Work periods occur at the same time each day. While rest periods are short, they occur twice a day and provide the opportunity for distributed rest. Sleep is likely to be taken during only one of the available rest periods. However, the change in activity pattern from that of the work period has restorative power. At this point it is appropriate to emphasize that sleep and rest are not synonymous.

Sleep is the fulfillment of a biological need that cannot be denied indefinitely. We don't know exactly why living creatures sleep, but we do know that, if denied sleep, the probability of going to sleep at the first opportunity goes way up over time.

The simplest definition of rest is what a person does when he says that he is relaxing. It is a desirable change in a pattern of activity that may involve the expenditure of greater energy than working. While that is not a very satisfying definition, it does cover the thousand and one things that people do when they say that they are resting. All of us can recognize sleep when we see it, but it's harder in the case of rest. Knowing your people well will help you to understand how they fulfill their rest requirements.

2. 8 hr-on: 8 hr-off (16 work hrs/24 hrs). This schedule gains four working hours per day per crew. The gain is bought at the cost of one rest cycle per day. (Assuming that everyone starts the schedule during a work period, even if that means a 16 hour day for one crew at start-up). The possibility of distributing rest is lost.

The schedule also "rolls" in the sense that work and rest periods are not stabilized at the same time of day

over succeeding days. A rolling schedule will place the rest period during the normal waking hours every third day. This provides an opportunity to conduct personal business during the normal waking hours of the non-shiftwork world.

A rolling schedule also desynchronizes the biological rhythms of all participants and keeps them desynchronized. There is a school of thought that believes this to be a desirable state of affairs and there have been suggestions that prior desynchronization may aid in adapting to a new time zone. While adoption of any shiftwork schedule causes desynchronization, resynchronization will normally occur in a month or two if the schedule is stabilized.

However, shiftwork in preparation for deployment will not be carried on long enough to produce a satisfactory adaptation. It will also be terminated by another desynchronizing event, i.e., the deployment operation itself. Given the present state of knowledge, we cannot definitively answer the question of whether partial resynchronization is better than none at all.

It is our best guess that the disruptions that occur during the preparations for deployment make the heaviest contributions to the performance deteriorations observed on landing at the destination point. This contribution is both direct in terms of the production of fatigue and accumulated sleep debt, and indirect in the sense that it places individuals at greater risk for suffering negative consequences of stressors encountered during the flight itself. On the basis of these considerations, we recommend that conditions be optimized during the period of preparation.

Optimization in the present context means avoiding shift schedules that "roll", or rotate. If, for good and proper reasons, rotating schedules cannot be avoided, then there is strong guidance concerning how they should be set up. Rotating schedules should be set up so that work periods occur later during each successive day. In the jargon of the shiftwork trade, this is called "phase delay". Phase advance, or starting the work periods earlier each day, has been shown to increase the negative consequences of rotating shifts. Fairly heavy physical work loads can be sustained over a number of weeks under this schedule. However, tasks requiring more than moderate

levels of intellectual effort and sustained attention will likely suffer.

3. 12 hr-on: 12 hr-off (12 work hrs/24 hrs). This is often the first shift schedule that people try when they are shorthanded and have a lot of work to do. The 12 hr-off period looks very attractive since it provides enough time for a normal sleep period (7 to 9 hours/day) and time to do personal business. It is easy to set up and maintain. People understand it and initial acceptance and compliance is high early in its operation. However, there is a problem created by the unbroken 12 hr on period.

If workloads are high, irrespective of whether they are physical or mental in character, then fatigue accumulates rather quickly on this schedule. This is especially true for the shift that spans the period of the early morning hours (0000-0600). It does not appear to make much difference whether this long night shift starts at 1800 or 2400, it is extremely wearing. The twelve hour continuous work period is difficult to sustain if vigilance any are physical or mental in character, then fatigue accumulates rather quickly on this schedule. This is especially true for the shift that spans the period of the early morning hours (0000-0600). It does not appear to make much difference whether this long night shift starts at 1800 or 2400, it is extremely wearing. The twelve hour continuous work period is difficult to sustain if vigilance and close attention to detailed work is required. The need for frequent rest breaks, especially near the end of the long shift may significantly reduce production.

In our experience, people with tough jobs prefer to work other schedules. Having attempted to make this point strongly, it must also be pointed out that under conditions of light to moderate physical and/or mental workloads, this schedule works out quite well.

The schedules outlined above clearly do not exhaust the possibilities for setting up shiftwork schedules. We have described some plain garden variety schedules that work if the considerations discussed above are taken into account. It is too easy to develop really exotic schedules that look good on paper but may be disasters in practice. You must take into consideration the nature of the work to be done, rest and sleep time, and where in the 24 hr day these things occur.



The question of when to sleep while on shiftwork has been difficult to answer in the past. Shiftworkers most often took their sleep when they could fit it into the pattern of family and social activities that surrounded them. Recent work has provided a clear answer to this question. Do your best to approximate a normal ACTIVITY pattern. This means taking your sleep prior to the start of your main activity period just as we do during normal work. This is especially difficult for people who work during the early morning hours. Interesting things happen in the evenings and the kids are likely to be at school during the morning. Nevertheless, sleeping in the morning is probably responsible for most of the chronic sleep deprivation experienced by nightworkers.

Lay the schedules that look feasible out on your planning sheets. This is the only way that you can determine whether or not there is appropriate coordination between sequential tasks and among main tasks. When a portion of a task is scheduled to be done between 0000 and 0600, give careful attention to whether or not your estimated completion time is accurate. Pay careful attention to the tasks that are to be accomplished during the latter part of the preparation period. You may want to take accumulated fatigue load into account and allow longer estimates of completion times. We cannot stress too strongly that conducting these exercises on your planning sheets is preferable to learning expensive lessons in practice.

After you have laid out your candidate shiftwork schedules on your planning sheets and made your adjustments for time-of-day and accumulated fatigue, you should find that one, or more, of the schedules fall to the left of the redline. If, after your best efforts, no schedule falls left of the redline, seek the counsel of higher command levels. There is something wrong with the contingency plan and you will be able to prove it. Assuming that more than one schedule qualifies, you must now decide among them. The amount of shortfall between when your schedule says the work will be completed and the redline defines the amount of contingency time that you have. Unless you can come up with some convincing reasons for doing otherwise, choose the schedule that gives you the greatest amount of contingency time.

Your primary use for contingency time is to make up for the inevitable delays that occur when bad things happen. If you get lucky and fewer bad things happen

because your carefully designed schedule has reduced the number of foul-ups and errors, you can plan for the secondary uses of contingency time. These involve providing blocks of time for additional rest, sleep, and personal business. Don't just give everyone the day off! Build these blocks of contingency time into the shift schedule and concentrate them in positions towards the end of the preparation period. By so doing, you can more readily handle late delays and the additional rest periods will occur when they will do most good.

At the risk of belaboring the obvious, we must repeat our earlier admonition to PRE-PLAN. The absolute need for it should now be apparent. It should also be obvious that getting tasks done prior to notification can pay handsome dividends during the preparation period. Your planning worksheets can be of considerable assistance in helping you to decide what jobs can and should be done ahead of time.

Earlier, we advised you to seek the help of higher authority if you couldn't arrive at a plan that would beat your redline. That advice was purposely premature and intended to motivate you to take your planning seriously and to think about other ways to meet the schedule. It is clear that every task that can be moved out of the preparation phase into the pre-notification period is worth identifying.

Your unit probably does not exist in isolation from the rest of the Army. Are there neighboring units who are not deploying that can lend a hand? Are there elements of your own unit that are going to stay behind? Can you negotiate for their aid and assistance, or order it if that is feasible? If there are, and if you plan ahead and accomplish the necessary coordination, then you can create contingency time where it might otherwise not have existed. Even if you are only able to get some of the necessary ash and trash details done, it will increase your manpower/time resources.

Another obvious point that we should not belabor. If an activity does not contribute directly or indirectly to the furtherance of the mission, DON'T DO IT! The U.S. Army has a long and honorable tradition of getting down to the basics in a combat zone. The deployment preparation phase is an excellent place to honor that tradition.

## APPENDIX II: EVALUATING A POST'S SOCIAL SUPPORTS

The questions in this section provide a fairly exhaustive analysis of the formal and informal social support climate on and around an Army post. The answers provide an inventory of what is available. They do not speak directly to the question of how well the available supports work. We suggest that you keep extensive notes concerning what you see and hear as you gather the necessary data. Pay attention to such factors as dependent medical system utilization, child and spouse abuse, and behavior problems in the local schools. Taken together, these diverse sources will provide useful qualitative data for your evaluation.

1. Where do our soldiers and their dependents live?
  - a. Who lives in quarters?
  - b. Who lives off post?
2. Concerning those who live off post:
  - a. Do they live in geographically clustered areas?
  - b. What are the physical relationships between where our soldiers live and the surrounding civilian community?
  - c. What kinds of transportation are available for dependents to use in reaching military and civilian support services?
3. Who are our dependents?
  - a. Is there a centralized file of their names, addresses, and phone numbers?
  - b. Who has children? What ages? Where do they go to school?
  - c. Who works?
  - d. What are the unit affiliations of their spouses?
4. What are the formal dependent service delivery agencies located on post?

- a. What specific services do they render?
  - b. What are the proportionate amounts of service delivered to dependents living on and off post?
  - c. Have these agencies established outreach programs to serve dependents living off post? If so, how have they structured these programs? How well do they work?
  - d. Do these agencies avail themselves of the services of volunteers drawn from on and off post communities? If so, how have they structured these programs? How well do they work?
  - e. Do these agencies coordinate a portion of their activities with like function civilian community agencies? How do they do it and how well does it work?
5. What formal civilian social service agencies deliver support services to military personnel and their dependents?
- a. What are the ranges and qualities of these services?
  - b. How effective is the coordination of service delivery between these agencies and military agencies?
6. What informal civilian organizations deliver services to military dependents?
- a. What churches?
  - b. What school-based organizations?
  - c. What civic organizations?
  - d. What service and charitable clubs?
  - e. What social clubs?
  - f. How do these informal organizations integrate their activities with formal military and civilian service agencies?
7. What is being done with these agencies to produce and enhance a cohesive sense of community among dependents?

a. Given the normal turbulence in the force, are there established procedures for orienting new arrivals to the military and civilian communities? Are these orientations conducted by volunteer groups to which the new arrivals might be expected to affiliate?

b. Is there a volunteer-operated telephone hotline service capable of providing information about and referral to both formal and informal service organizations?

c. Is there a volunteer-operated transportation service to improve access to service agencies?

d. Is there a "buddy" system for dependents through which more experienced members of the community can show new arrivals "the ropes."

e. Is there an information outreach program to critical elements of the civilian and military community that explains, to the extent possible, the unit's missions and relates those missions to the special problems of deployment?

If you have waded this far through all of these questions and provided yourself with honest answers, then you know a great deal about the social support system on your post and in your community. You have probably also turned some of the original "No" answers to "Yesses" and plan to do something about the rest. Have you enlisted your local communications media in support of your efforts? In a reporter's terms, community self-help activities make good positive copy. That kind of coverage reinforces the worth of what you are doing, helps to recruit new volunteers, and doesn't hurt the Army's image one bit. The P.I.O. can set up and coordinate coverage, but let the people who are doing do the talking. Their interest, commitment and pride will communicate itself clearly.

Here is a final set of questions that should be answered in the affirmative if you are going to mobilize all of the social supports that you have identified on and around your post:

1. Does every soldier have a clear idea about what duties he or she will be performing during preparation for deployment? Has that schedule been communicated to dependents?

2. Has every soldier prepared a personal checklist of the personal business that he or she must complete prior to deployment? Have difficulties been identified and strategies for coping with them been worked out?

3. Are critical military and civilian service delivery agencies prepared to modify their hours of operations in order to accommodate the needs of soldiers working in a sustained operations mode?

4. Are the volunteer organizations that supply social supports prepared to modify their operations to accommodate the needs of dependents whose spouses are working in a sustained operations mode?

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